Appendix K3

# *TCEQ Edwards Aquifer Regulatory Evaluation*

# 1.1 BACKGROUND

## 1.1.1 Introduction

The US 281 Environmental Impact Statement (EIS) is being prepared for the Alamo Regional Mobility Authority (Alamo RMA) to evaluate improvements to the US 281 roadway from Loop 1604 to Borgfeld Drive. The project limits fall completely within Bexar County and include the floodplains of Mud Creek, two unnamed tributaries to Mud Creek, West Elm Creek, Elm Waterhole Creek, and unnamed tributaries Cibolo Creek.

## 1.1.2 Purpose

This report outlines the procedure used to evaluate the compliance of all proposed build alternatives to meet the current regulatory requirements mandated by the Texas Commission on Environmental Quality (TCEQ), as well as the City of San Antonio requirement that proposed storm water runoff not increase from original conditions. One no-build alternative and two build alternatives were evaluated via the methodology detailed herein and the resulting conclusions are included in this report.

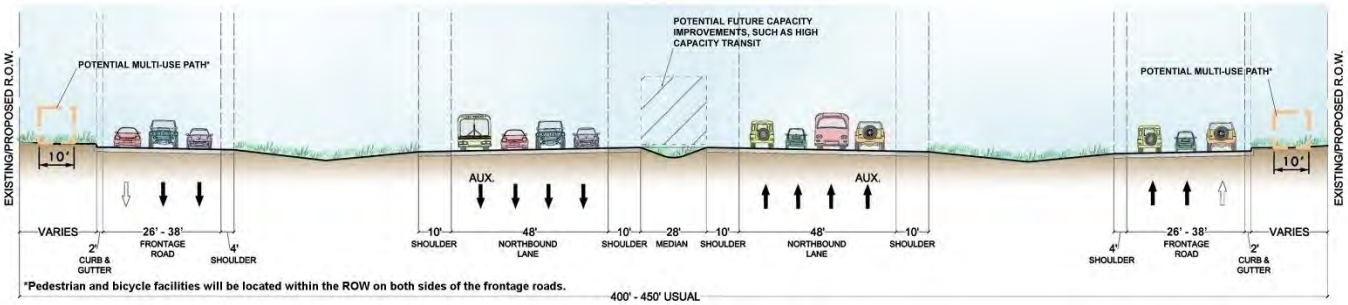
## 1.1.3 Alternatives

All build alternatives being evaluated will increase the quantity of impervious cover as they propose the construction of frontage roads, elevated roadways, and connector ramps. The proposed alternatives are summarized below; reference Section 3.9 of the US 281 Draft EIS for additional information.

### Expressway Alternative

This alternative consists of three, full access-controlled through travel lanes in each direction (**Figure K3-1**). The express lanes would be situated between partial access-controlled outer lanes, also known as frontage roads. The frontage road lanes, which would cross local streets at grade via signalized intersections, would be continuous for the length of the proposed project and serve local traffic by providing direct access to businesses, neighborhoods and connecting streets. Under this alternative neither the existing US 281 travel lanes nor the existing US 281 Super Street would remain in place. Four direct connector ramps would be provided at Loop 1604 to provide mainlane to mainlane connections for US 281 motorists travelling westbound Loop 1604 to northbound US 281, southbound US 281 to eastbound Loop 1604, eastbound Loop 1604 to northbound US 281, and southbound US 281 to westbound Loop 1604. The proposed ROW would typically be 400 to 450 feet wide (wider at the interchanges). North of Sonterra Boulevard, the main lanes would be separated by a 28-foot median capable of supporting potential future capacity improvements, such as high capacity transit. The Expressway Alternative requires approximately 128 acres of additional ROW.

Figure K3-1: Expressway Alterntive typical section




Source: US 281 EIS Team, 2012.

## Elevated Expressway Alternative

This alternative consists of two-to-three, full access-controlled through travel lanes in each direction. No streets or driveways would access the through lanes directly. The express lanes would be elevated for the length of the project corridor. At Loop 1604, the northbound and southbound elevated express lanes will connect directly to eastbound and westbound Loop 1604. From Loop 1604 north to Stone Oak Parkway, the elevated express lanes would be built on the outside of the existing US 281 roadway (**Figure K3-2a)** and would transition to the west side of the existing US 281 roadway north of Stone Oak Parkway to Borgfeld Drive (**Figure K3-2b**). The existing US 281 travel lanes, including a portion of the US 281 Super Street, would remain in place as partial access-controlled lanes, crossing local streets at grade via signalized intersections for the length of the proposed project, serving local traffic by providing direct access to businesses, neighborhoods and connecting streets. The proposed ROW would typically be 384 to 400 feet wide. A median of 37 feet (average width) would provide for potential future capacity improvements, such as high capacity transit, south of Stone Oak Parkway. After the northbound elevated section shifts to the west side of existing US 281, the area for potential future capacity improvements shifts to between the elevated structures and continues north to Borgfeld Drive. The Elevated Expressway Alternative requires approximately 99 acres of additional ROW.

Figure K3-2a: Elevated Expressway Alternative typical section(south of Stone Oak Parkway)

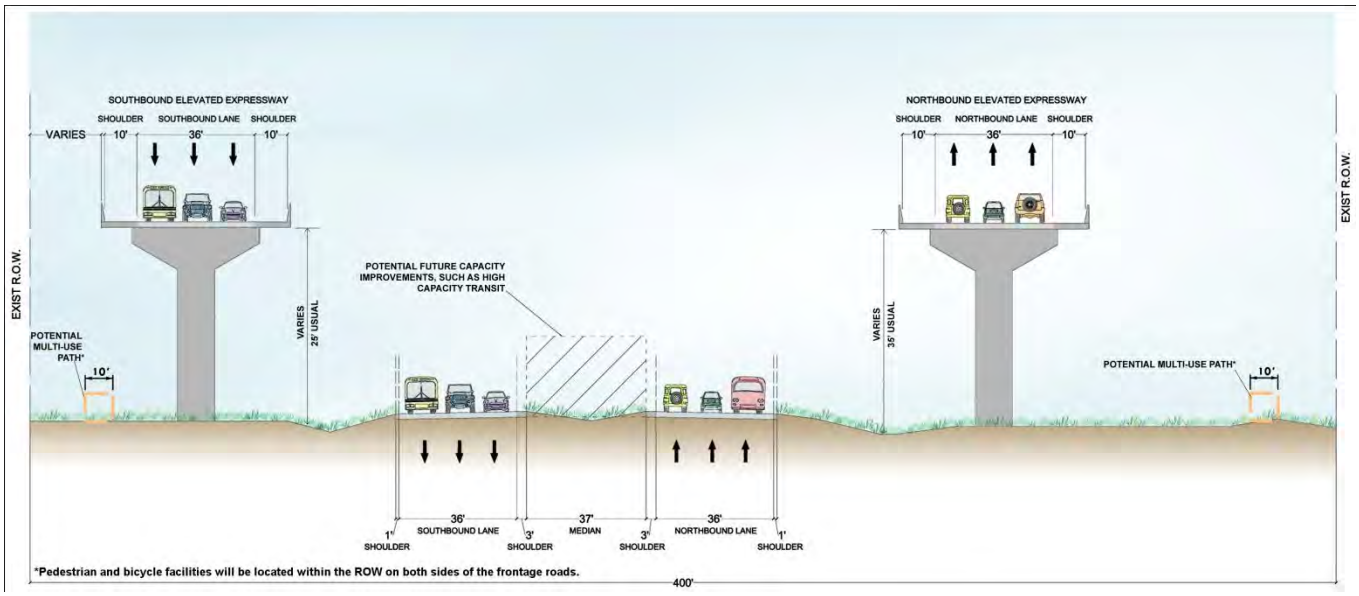
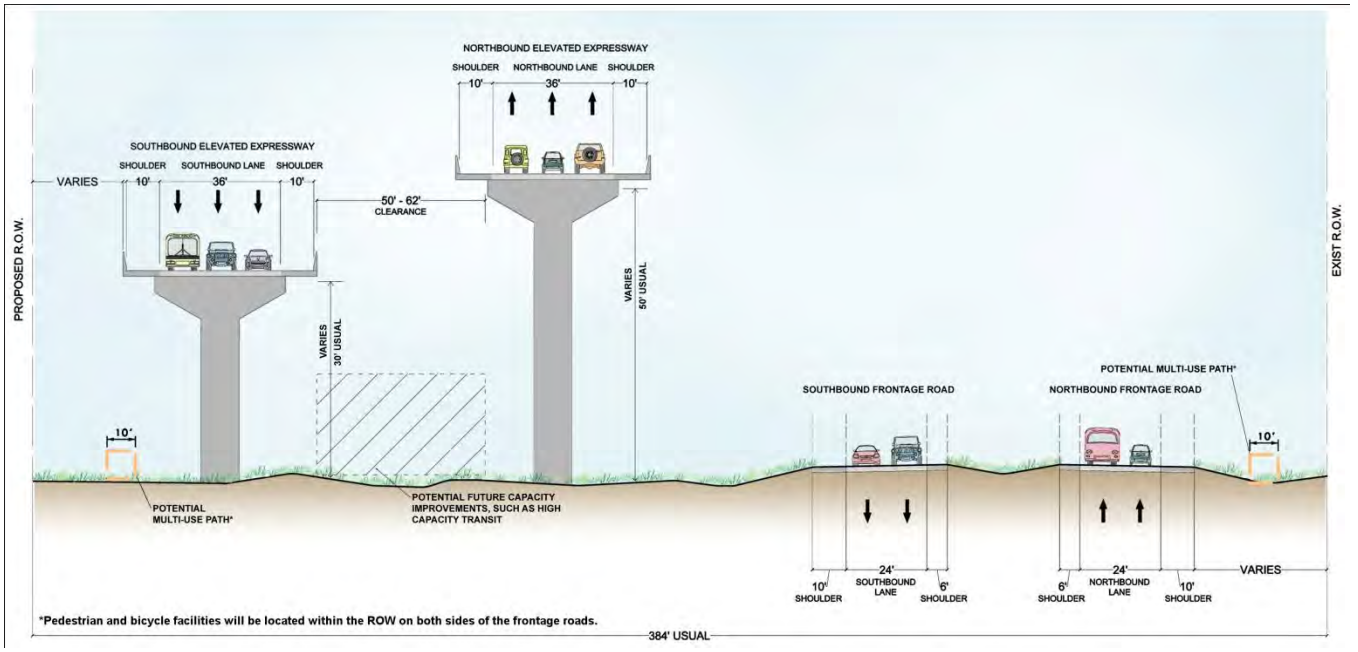



Figure K3-2b: Elevated Expressway Alternative typical section (north of Stone Oak Parkway)




Source: US 281 EIS Team, 2011.

## No-Build Alternative

The No-Build Alternative is considered the baseline alternative for comparison to the two Proposed Build Alternatives. Under the No-Build Alternative, the existing transportation infrastructure in the project corridor would remain unchanged for the foreseeable future. This report does not include a drainage evaluation for the No-Build Alternative as it is assumed any existing impervious cover is

compliant with the TCEQ requirements in place at the time of construction; all future impervious cover additions would be subject to regulations in place at the time.

### 1.1.4 Regulatory Requirements

All build alternatives are located on the recharge zone of the Edwards Aquifer and are thus subject to Title 30 Chapter 213 of the Texas Administrative Code which regulates any activity having the potential for polluting the Edwards Aquifer and hydrologically connected surface streams.

As previously noted, all build alternatives propose the addition of impermeable surfaces, primarily in the form of expanded roadways, which prevent the natural infiltration of water into the soil and are therefore defined by TCEQ as impervious cover areas. Impervious cover increases the potential for surface water contamination with suspended solids, thus introducing an increased risk of groundwater degradation as a result. To prevent contaminated storm water from reaching downstream receiving waters and groundwater, TCEQ regulates the total suspended solids (TSS) load permitted to leave the site by requiring an Edwards Aquifer protection plan that must reduce the increase in TSS load associated with development by at least 80%.

Prior to commencement of construction, an Edwards Aquifer protection plan must be filed and approved in compliance with TCEQ regulations. The rules and regulations for any regulated activity within the Edwards Aquifer recharge zone are available for reference in Texas Administrative Code Title 30 Chapter 213 Subchapter A.

Acceptable methods of solids removal are listed in the TCEQ Technical Guidance Manual (Complying with the Edwards Aquifer Rules – Technical Guidance on Best Management Practices, TCEQ, July 2005) which includes design criteria. Sand filter ponds are a common Best Management Practice (BMP) used that allows for settling and filtration of solids.

The objective of sand filters is to remove sediment and pollutants from the first flush of pavement and impervious area runoff. The filtration of nutrients, organics, and coliform bacteria is enhanced by a mat of bacterial slime that develops during normal operations. One of the main advantages of sand filters is their adaptability; they can be used on areas with thin soils, high evaporation rates, low-soil infiltration rates, in limited spaces areas, and where groundwater is to be protected.

## 1.2 METHODOLOGY

The purpose of this study is to evaluate the compliance of the three alternatives with the TCEQ Edwards Aquifer Protection Program rules. Each alternative will be evaluated to determine whether it can meet the required TSS removal as required by TCEQ. TSS removal is achieved by directing the first flush of runoff to a pond having the volume required as specified by TCEQ calculations.

### 1.2.1 Treatment Method

For this analysis, sand filter ponds, also referred to as water quality ponds are assumed to be the primary treatment best management practice (BMP). Calculations are provided for all watersheds using the same treatment. By using the same treatment on all watersheds, the ability to obtain treatment

within a watershed can be more easily judged. Sand Filters are a commonly used BMP for projects with a large increase in pavement areas with right-of-way constraints. Other BMPs may be incorporated into the final design; however it is a conservative approach to evaluate each alternative using the sand filter pond design.

### 1.2.2 Watersheds

The proposed project area has been divided into watersheds in order to estimate the required and obtainable TSS removal. Each watershed has been evaluated for the amount of TSS increase, the removal required and the amount of removal obtained from the proposed BMP.

### 1.2.3 Calculations

Calculations have been performed utilizing TCEQ's equations/spreadsheet for TSS generation and removal. Summary sheets from those calculations are included as **Appendix A and B**. Basin sizes required for appropriate TSS removal have also been calculated and are presented in the summary.

Inputs required for the TSS calculations included the total project area, the County in which the project resides (for rainfall determination), the amount of existing and proposed impervious areas. As mandated by TCEQ, 80% removal of the increase in TSS is calculated as a required removal. All existing impervious cover is assumed to have been installed per regulatory rules (if any) at the time of their installation. Therefore, the No Build Alternative will not require calculations for TSS removal. There are no requirements for the treatment of the existing impervious cover therefore the two alternatives which include options for proposed pavement will only treat the additional TSS created from the increase in impervious cover.

### 1.2.4 Procedure

Electronic files of the proposed alternatives were used to obtain all proposed impervious cover calculations. The procedure below has been used to evaluate each alternative:

1. Generate impervious areas using CAD within the right-of-way for each alternative.
2. Combine existing and proposed areas in order to obtain the total post construction impervious cover
3. Identify potential locations for water quality ponds.
4. Calculate existing and proposed impervious cover within each watershed defined by locations of water quality ponds.
5. Use spreadsheet to determine the TSS removal goals for each watershed and estimate basin volumes to achieve the required removal.
6. Examine the footprint of the basins required and develop proposed right-of-way needs.

### 1.2.5 Assumptions and Clarifications

The following assumptions have been made in the development of this analysis:

- There are several approaches to location/design of water quality basins. Once a reasonable approach to meeting the treatment goal was identified, no other consideration for size, location

and treatment was made. Further design of all water quality features will be required during final design.

- All existing impervious cover is assumed to have been installed per regulatory rules (if any) at the time of their installation and no treatment will be included in calculations for existing impervious cover. There are no requirements for treating existing impervious cover, only that increased impervious cover from the proposed project.
- All pond locations are approximate and exact locations will be identified during final design.
- A detailed drainage design will be required during the final design for all of the alternatives other than the No Build alternative.
- This report has been provided to determine whether treatment goals can be met. Development of the water quality basins during the final design will require the evaluation of best location and design configuration for the basins.

## 1.3 EVALUATION

### 1.3.1 Evaluation Criteria

Each alternative was evaluated utilizing the following questions:

- Are the TSS removal requirements set by TCEQ provided?
- Is the required TSS removal provided within the specified right-of-way limits or will additional right-of-way be required?

### 1.3.2 Evaluations Results

The following table presents a summary of the results.

**Table 1: Summary of Results**

| Alternative | Total Number of Major Watersheds | Total Number of BMP Watersheds/ Basins | Total TSS Removal Required (lbs) | TCEQ Requirements Met (Y/N) | Number of Basins Requiring Additional Right-of-Way |
|---|---|---|---|---|---|
| **No Build** | N/A | N/A | N/A | N/A | N/A |
| **Expressway** | 23 | 30 | 80,481 | Y | 16 |
| **Elevated Expressway** | 23 | 23 | 93,236 | Y | 0 |

Source: US 281 EIS Team, 2012

### 1.3.3 Ability to Provide Required Treatment

The Proposed Build Alternatives evaluated are capable of meeting the TCEQ requirements for TSS removal.

### 1.3.4 Additional Right-of-Way Requirements

The Elevated Expressway Alternative would not require any additional right-of-way outside of what is already planned for roadway expansion. The Expressway Alternative would require purchase of additional right-of-way for the water quality basins.

### 1.3.5 No Build

The existing impervious cover is assumed to be in compliance with all TCEQ regulations and the No Build option would not require any TCEQ coordination and all goals are considered met.

## 1.4 CONCLUSIONS

Both Proposed Build Alternatives are able to meet the current regulatory requirements set forth by TCEQ for the entire project area. Therefore, a WPAP in accordance with current regulations could be prepared for either alternative selected for construction.

- The Expressway Alternative adds the lesser amount of impervious cover and therefore would require less treatment; however it would require additional right-of-way areas to obtain the required amount of TSS removal required.
- The Elevated Expressway Alternative requires more additional impervious cover yet would require no additional right-of-way for water quality purposes to obtain the required amount of TSS removal.

As mentioned early, the evaluation was performed using only sand filter basins as a BMP to be able to directly compare the build options. Sand filter basins are one option of several permanent controls approved by TCEQ. Others include

- Retention/Irrigation
- Extended Detention Basins
- Grassy Swales
- Vegetative Filter Strips
- Bioretention
- Wet Basins
- Constructed Wetlands
- Permeable Concrete

Various innovative technologies have also been approved by TCEQ for use within the recharge zones of the Edwards Aquifer. These methods include

- Contech StormFilter
- Stormceptor
- Vortechs

This list is subject to change by TCEQ and all methods should be verified with TCEQ's current approved list at the time of final design.

# Appendix A - Impervious Cover Summary

## Impervious Cover Summary – Expressway Alternative

**EXPRESSWAY ALTERNATIVE**

| Name | Total On-Site Area (acres) | Existing On-Site Impervious Area (acres) | Proposed On-Site Impervious Area (acres) | Proposed Increase in Impervious Area (acres) | Existing On-Site % Impervious | Proposed On-Site % Impervious |
|---|---|---|---|---|---|---|
| AA | 18.68 | 12.32 | 12.78 | 0.46 | 65.95 | 68.41 |
| A | 12.06 | 4.78 | 8.61 | 3.83 | 39.66 | 71.41 |
| B | 18.74 | 3.30 | 8.78 | 5.48 | 17.60 | 46.83 |
| C,D | 13.03 | 3.18 | 7.58 | 4.40 | 24.41 | 58.19 |
| E,F | 16.29 | 3.97 | 9.84 | 5.87 | 24.34 | 60.39 |
| G | 17.60 | 4.79 | 12.05 | 7.26 | 27.23 | 68.47 |
| H | 10.50 | 2.66 | 6.97 | 4.31 | 25.32 | 66.34 |
| I1 | 14.89 | 4.01 | 9.32 | 5.31 | 26.91 | 62.58 |
| I2 | 13.93 | 2.72 | 6.84 | 4.13 | 19.49 | 49.12 |
| J,K | 18.82 | 4.52 | 9.73 | 5.21 | 24.00 | 51.69 |
| L | 13.00 | 1.60 | 5.62 | 4.01 | 12.34 | 43.21 |
| M | 27.02 | 4.20 | 10.88 | 6.68 | 15.56 | 40.28 |
| N | 12.44 | 3.03 | 6.85 | 3.81 | 24.36 | 55.01 |
| O | 13.97 | 4.95 | 6.09 | 1.14 | 35.46 | 43.60 |
| OO | 50.40 | 11.85 | 21.39 | 9.55 | 23.50 | 42.45 |
| P | 13.41 | 3.19 | 4.80 | 1.62 | 23.75 | 35.80 |
| Q | 27.22 | 6.32 | 13.84 | 7.51 | 23.23 | 50.83 |
| R | 22.59 | 7.93 | 10.78 | 2.85 | 35.09 | 47.72 |
| S | 19.42 | 10.87 | 10.91 | 0.04 | 55.96 | 56.16 |
| T | 13.81 | 4.40 | 7.01 | 2.61 | 31.87 | 50.76 |
| U | 26.20 | 5.98 | 12.68 | 6.70 | 22.82 | 48.38 |
| V | 24.03 | 4.83 | 7.71 | 2.88 | 20.10 | 32.10 |
| W | 28.74 | 5.82 | 8.79 | 2.97 | 20.24 | 30.58 |
| **TOTAL** | 446.79 | 121.20 | 219.83 | 98.63 | | |

## Impervious Cover Summary – Elevated Expressway Alternative

| ELEVATED EXPRESSWAY ALTERNATIVE | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Total On-Site Area (acres)** | **Existing On-Site Impervious Area (acres)** | **Proposed On-Site Impervious Area (acres)** | **Proposed Increase in Impervious Area (acres)** | **Existing On-Site % Impervious** | **Proposed On-Site % Impervious** |
| AA | 16.30 | 10.61 | 12.81 | 2.20 | 65.09 | 78.56 |
| A | 10.95 | 5.77 | 7.44 | 1.68 | 52.65 | 67.95 |
| B | 10.66 | 2.32 | 4.10 | 1.78 | 21.77 | 38.43 |
| C | 12.18 | 3.12 | 4.18 | 1.05 | 25.64 | 34.30 |
| D | 12.49 | 3.25 | 6.86 | 3.62 | 25.98 | 54.94 |
| E | 5.40 | 1.19 | 2.69 | 1.50 | 22.08 | 49.90 |
| F | 12.29 | 2.89 | 5.95 | 3.06 | 23.50 | 48.36 |
| G | 20.83 | 5.89 | 12.13 | 6.23 | 28.29 | 58.21 |
| H | 14.54 | 4.76 | 8.04 | 3.28 | 32.76 | 55.32 |
| I | 27.49 | 6.75 | 17.55 | 10.80 | 24.56 | 63.84 |
| J | 10.03 | 2.36 | 5.05 | 2.69 | 23.55 | 50.40 |
| K | 9.40 | 3.21 | 4.11 | 0.90 | 34.18 | 43.77 |
| L | 8.45 | 1.93 | 3.38 | 1.45 | 22.83 | 39.95 |
| M | 31.73 | 4.97 | 11.42 | 6.45 | 15.65 | 35.99 |
| N | 14.28 | 3.23 | 7.08 | 3.84 | 22.66 | 49.59 |
| O | 15.07 | 5.65 | 8.37 | 2.72 | 37.46 | 55.53 |
| OO | 48.26 | 12.00 | 28.00 | 16.00 | 24.87 | 58.02 |
| P | 12.39 | 3.71 | 6.80 | 3.09 | 29.97 | 54.88 |
| Q | 22.14 | 5.70 | 12.35 | 6.64 | 25.77 | 55.77 |
| R | 15.22 | 6.58 | 9.06 | 2.48 | 43.23 | 59.54 |
| S | 24.65 | 11.83 | 12.93 | 1.09 | 48.00 | 52.44 |
| T | 11.50 | 6.18 | 7.10 | 0.92 | 53.73 | 61.76 |
| U | 23.19 | 4.76 | 9.83 | 5.07 | 20.50 | 42.38 |
| V | 16.49 | 5.40 | 6.86 | 1.46 | 32.75 | 41.58 |
| W | 28.69 | 5.86 | 7.76 | 1.90 | 20.41 | 27.03 |
| **TOTAL** | 434.65 | 129.94 | 221.84 | 91.91 | | |

# Appendix B - Detention and Water Quality Summary

## Detention Summary – Expressway Alternative

| Basin Name | EXISTING ROADWAY | | EXPRESSWAY ALTERNATIVE | | Estimated Detention (CF) | Depth ft. | Detention Area SF | Detention 10% increase SF | Width ft. | Required Length |
|---|---|---|---|---|---|---|---|---|---|---|
| | DA (ac) | % IC | DA (ac) | % IC | | | | | | |
| AA | 18.68 | 65.95 | 18.68 | 68.41 | 15,104 | 4 | 3,776 | 4,154 | 60 | 69 |
| A | 12.1 | 39.66 | 12.06 | 71.41 | 38701 | 4 | 9,675 | 10,643 | 60 | 177 |
| B | 18.7 | 17.60 | 18.74 | 46.83 | 55436 | 4 | 13,859 | 15,245 | 75 | 203 |
| C,D | 13.0 | 3.18 | 13.03 | 7.58 | 44,606 | 4 | 11,152 | 12,267 | 55 | 223 |
| E,F | 16.3 | 3.97 | 16.29 | 9.84 | 59,672 | 4 | 14,918 | 16,410 | 100 | 164 |
| G | 17.6 | 4.79 | 17.60 | 12.05 | 74,261 | 4 | 18,565 | 20,422 | 100 | 204 |
| H | 10.5 | 2.66 | 10.50 | 6.97 | 44,112 | 4 | 11,028 | 12,131 | 40 | 303 |
| I1 | 14.9 | 4.01 | 14.89 | 9.32 | 53,859 | 4 | 13,465 | 14,811 | 80 | 185 |
| I2 | 13.9 | 2.72 | 13.93 | 6.84 | 41,682 | 4 | 10,421 | 11,463 | 45 | 255 |
| J,K | 18.8 | 4.52 | 18.82 | 9.73 | 52,667 | 4 | 13,167 | 14,483 | 55 | 263 |
| J | 9.4 | 2.3 | 9.4 | 4.9 | 26333.3 | 4 | 6,583 | 7,242 | 55 | 132 |
| K | 9.4 | 2.3 | 9.4 | 4.9 | 26333.3 | 4 | 6,583 | 7,242 | 55 | 132 |
| L | 13.0 | 1.60 | 13.00 | 5.62 | 40,701 | 5 | 8,140 | 8,954 | 50 | 179 |
| M | 27.0 | 4.20 | 27.02 | 10.88 | 67,534 | 5 | 13,507 | 14,857 | 55 | 270 |
| N | 12.4 | 3.03 | 12.44 | 6.85 | 38,523 | 4 | 9,631 | 10,594 | 50 | 212 |
| O | 14.0 | 4.95 | 13.97 | 6.09 | 15,455 | 4 | 3,864 | 4,250 | 50 | 85 |
| OO1* | 17.6 | 4.15 | 17.64 | 7.49 | 22,313 | 4 | 5,578 | 6,136 | 50 | 123 |
| OO2* | 35.3 | 8.3 | 35.3 | 15.0 | 44626 | 5 | 8,925 | 9,818 | 75 | 131 |
| OO3* | 7.6 | 1.8 | 7.6 | 3.2 | 9563 | 3 | 3,188 | 3,506 | 40 | 88 |
| P | 13.4 | 3.19 | 13.41 | 4.80 | 18,472 | 3 | 6,157 | 6,773 | 50 | 135 |
| Q | 27.2 | 6.32 | 27.22 | 13.84 | 75,918 | 5 | 15,184 | 16,702 | 70 | 239 |
| R | 22.6 | 7.93 | 22.59 | 10.78 | 33,113 | 5 | 6,623 | 7,285 | 60 | 121 |
| S | 19.4 | 10.87 | 19.42 | 10.91 | 11,718 | 5 | 2,344 | 2,578 | 50 | 52 |
| T | 13.8 | 4.40 | 13.81 | 7.01 | 27,487 | 5 | 5,497 | 6,047 | 50 | 121 |
| U1 | 18.3 | 4.19 | 18.34 | 8.87 | 47,481 | 5 | 9,496 | 10,446 | 75 | 139 |
| U2 | 7.9 | 1.79 | 7.86 | 2.31 | 20,349 | 5 | 4,070 | 4,477 | 50 | 90 |
| V1 | 12.0 | 2.41 | 12.01 | 3.86 | 16,339 | 4 | 4,085 | 4,493 | 50 | 90 |
| V2 | 12.0 | 2.41 | 12.01 | 3.86 | 16,339 | 4 | 4,085 | 4,493 | 50 | 90 |
| W | 28.7 | 5.82 | 28.74 | 8.79 | 35,092 | 5 | 7,018 | 7,720 | 50 | 154 |

* Area for OO was divided into 3 sets of ponds.

# Water Quality Summary – Expressway Alternative

| | Sedimentation | | | | | | Filtration | | | | | Required | | | | Actual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin Name | Required WQ Sed Volume CF | Depth ft. | Sedimentation Area SF | Sedimentation 40% increase SF | Width ft. | Required Length ft. | Required WQ Filtration Area SF | Width ft. | Required Length ft. | Length Used ft. | Actual Filtration SF | Total WQ Area SF | Width ft. | Required Length ft. | Length Used ft. | Total WQ Area SF |
| AA | 1595 | 4 | 399 | 574 | 30 | 19 | 0 | 30 | 0 | 30 | 900 | 574 | 30 | 19 | 49 | 1474 |
| A | 7623 | 4 | 1906 | 2744 | 30 | 91 | 353 | 30 | 12 | 30 | 900 | 3097 | 30 | 103 | 121 | 3644 |
| B | 13179 | 4 | 3295 | 4745 | 30 | 158 | 610 | 30 | 20 | 30 | 900 | 5355 | 30 | 178 | 188 | 5645 |
| C,D | 10066 | 4 | 2516 | 3624 | 30 | 121 | 466 | 30 | 16 | 30 | 900 | 4090 | 30 | 136 | 151 | 4524 |
| E,F | 13455 | 4 | 3364 | 4844 | 50 | 97 | 623 | 50 | 12 | 50 | 2500 | 5467 | 50 | 109 | 147 | 7344 |
| G | 17343 | 4 | 4336 | 6244 | 50 | 125 | 803 | 50 | 16 | 50 | 2500 | 7046 | 50 | 141 | 175 | 8744 |
| H | 10214 | 4 | 2554 | 3677 | 40 | 92 | 473 | 40 | 12 | 40 | 1600 | 4150 | 40 | 104 | 132 | 5277 |
| I1 | 12036 | 4 | 3009 | 4333 | 50 | 87 | 557 | 50 | 11 | 50 | 2500 | 4890 | 50 | 98 | 137 | 6833 |
| I2 | 9588 | 4 | 2397 | 3452 | 40 | 86 | 444 | 40 | 11 | 40 | 1600 | 3896 | 40 | 97 | 126 | 5052 |
| J,K | 11521 | 4 | 2880 | 4148 | 40 | 104 | 533 | 40 | 13 | 40 | 1600 | 4681 | 40 | 117 | 144 | 5748 |
| J | 5761 | 4 | 1440 | 2074 | 30 | 69 | 267 | 30 | 9 | 30 | 900 | 2341 | 30 | 78 | 99 | 2974 |
| K | 5761 | 4 | 1440 | 2074 | 30 | 69 | 267 | 30 | 9 | 30 | 900 | 2341 | 30 | 78 | 99 | 2974 |
| L | 11267 | 4 | 2817 | 4056 | 40 | 101 | 522 | 40 | 13 | 40 | 1600 | 4578 | 40 | 114 | 141 | 5656 |
| M | 16721 | 4 | 4180 | 6020 | 40 | 150 | 774 | 40 | 19 | 40 | 1600 | 6794 | 40 | 170 | 190 | 7620 |
| N | 8576 | 4 | 2144 | 3087 | 30 | 103 | 397 | 30 | 13 | 30 | 900 | 3484 | 30 | 116 | 133 | 3987 |
| O | 1737 | 4 | 434 | 625 | 30 | 21 | 80 | 30 | 3 | 30 | 900 | 706 | 30 | 24 | 51 | 1525 |
| O&P1 | 6832 | 3 | 2277 | 3279 | 40 | 82 | 316 | 40 | 8 | 40 | 1600 | 3596 | 40 | 90 | 122 | 4879 |
| O&P2 | 13664 | 4 | 3416 | 4919 | 50 | 98 | 633 | 50 | 13 | 50 | 2500 | 5552 | 50 | 111 | 148 | 7419 |
| O&P3 | 2928 | 3 | 976 | 1405 | 30 | 47 | 136 | 30 | 5 | 30 | 900 | 1541 | 30 | 51 | 77 | 2305 |
| P | 3072 | 3 | 1024 | 1475 | 25 | 59 | 142 | 25 | 6 | 30 | 750 | 1617 | 25 | 65 | 89 | 2225 |
| Q | 16444 | 4 | 4111 | 5920 | 40 | 148 | 761 | 40 | 19 | 30 | 1200 | 6681 | 40 | 167 | 178 | 7120 |
| R | 4611 | 4 | 1153 | 1660 | 40 | 41 | 213 | 40 | 5 | 40 | 1600 | 1873 | 40 | 47 | 81 | 3260 |
| S | 1334 | 5 | 267 | 384 | 30 | 13 | 62 | 30 | 2 | 30 | 900 | 446 | 30 | 15 | 43 | 1284 |
| T | 4535 | 5 | 907 | 1306 | 30 | 44 | 210 | 30 | 7 | 30 | 900 | 1516 | 30 | 51 | 74 | 2206 |
| U1 | 10308 | 5 | 2062 | 2969 | 40 | 74 | 477 | 40 | 12 | 40 | 1600 | 3446 | 40 | 86 | 114 | 4569 |
| U2 | 4418 | 4 | 1104 | 1590 | 30 | 53 | 205 | 30 | 7 | 30 | 900 | 1795 | 30 | 60 | 90 | 2700 |
| V1 | 2930 | 4 | 732 | 1055 | 25 | 42 | 341 | 30 | 11 | 30 | 900 | 1396 | 25 | 56 | 90 | 2250 |
| V2 | 2930 | 4 | 732 | 1055 | 30 | 35 | 341 | 30 | 11 | 30 | 900 | 1396 | 30 | 47 | 90 | 2700 |
| W | 5992 | 4 | 1498 | 2157 | 30 | 72 | 277 | 30 | 9 | 30 | 900 | 2435 | 30 | 81 | 102 | 3057 |

## Detention Summary – Elevated Expressway Alternative

| Basin Name | EXISTING ROADWAY | | ELEVATED EXPRESSWAY ALTERNATIVE | | Estimated Detention (CF) | Depth ft. | Detention Area SF | Detention 10% increase SF | Width ft. | Required Length |
|---|---|---|---|---|---|---|---|---|---|---|
| | DA (ac) | % IC | DA (ac) | % IC | | | | | | |
| AA | 10.95 | 65.09 | 16.30 | 78.56 | 11,212 | 4 | 2,803 | 3,083 | 50 | 62 |
| A | 10.7 | 52.65 | 10.95 | 67.95 | 19165 | 4 | 4,791 | 5,270 | 50 | 106 |
| B | 12.2 | 21.77 | 10.66 | 38.43 | 18817 | 6 | 3,136 | 3,450 | 200 | 17 |
| C | 12.5 | 25.64 | 12.18 | 34.30 | 13,531 | 4 | 3,383 | 3,721 | 94 | 40 |
| D | 5.4 | 25.98 | 12.49 | 54.94 | 36,540 | 4 | 9,135 | 10,049 | 48 | 209 |
| E | 12.3 | 22.08 | 5.40 | 49.90 | 15,164 | 3 | 5,055 | 5,560 | 40 | 139 |
| F | 20.8 | 23.50 | 12.29 | 48.36 | 30,999 | 4 | 7,750 | 8,525 | 46 | 185 |
| G | 14.5 | 28.29 | 20.83 | 58.21 | 62,932 | 4 | 15,733 | 17,306 | 62 | 277 |
| H | 27.5 | 32.76 | 14.54 | 55.32 | 33,765 | 4 | 8,441 | 9,285 | 58 | 160 |
| I | 10.0 | 24.56 | 27.49 | 63.84 | 110,214 | 4 | 27,554 | 30,309 | 80 | 379 |
| J | 9.4 | 23.6 | 10.0 | 50.4 | 27224.0 | 4 | 6,806 | 7,487 | 50 | 150 |
| K | 8.5 | 34.2 | 9.4 | 43.8 | 11408.7 | 4 | 2,852 | 3,137 | 47 | 67 |
| L | 31.7 | 22.83 | 8.45 | 39.95 | 15,269 | 4 | 3,817 | 4,199 | 41 | 102 |
| M | 14.3 | 15.65 | 31.73 | 35.99 | 66,109 | 4 | 16,527 | 18,180 | 105 | 173 |
| N | 15.1 | 22.66 | 14.28 | 49.59 | 38,932 | 4 | 9,733 | 10,706 | 106 | 101 |
| O | 48.3 | 37.46 | 15.07 | 55.53 | 29,071 | 4 | 7,268 | 7,995 | 25 | 320 |
| OO | 12.4 | 24.87 | 48.26 | 58.02 | 161,954 | 6 | 26,992 | 29,692 | 50 | 600 |
| P | 12.4 | 29.97 | 12.39 | 54.88 | 31,442 | 4 | 7,861 | 8,647 | 99 | 87 |
| Q | 22.1 | 25.8 | 22.1 | 55.8 | 67145 | 4 | 16,786 | 18,465 | 102 | 180 |
| R | 15.2 | 43.2 | 15.2 | 59.5 | 27432 | 4 | 6,858 | 7,544 | 129 | 58 |
| S | 24.6 | 48.00 | 24.65 | 52.44 | 21,615 | 4 | 5,404 | 5,944 | 100 | 59 |
| T | 11.5 | 53.73 | 11.50 | 61.76 | 13,495 | 4 | 3,374 | 3,711 | 122 | 30 |
| U | 23.2 | 20.50 | 23.19 | 42.38 | 51,805 | 5 | 10,361 | 11,397 | 120 | 95 |
| V | 16.5 | 32.75 | 16.49 | 41.58 | 18,992 | 4 | 4,748 | 5,223 | 68 | 77 |
| W | 28.7 | 20.41 | 28.69 | 27.03 | 26,597 | 4 | 6,649 | 7,314 | 48 | 152 |

# Water Quality Summary – Elevated Expressway Alternative

| | Sedimentation | | | | | | Filtration | | | | | Required | | | | Actual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin Name | Required WQ Sed Volume CF | Depth ft. | Sedimentation Area SF | Sedimentation 40% increase SF | Width ft. | Required Length ft. | Required WQ Filtration Area SF | Width ft. | Required Length ft. | Length Used ft. | Actual Filtration SF | Total WQ Area SF | Width ft. | Required Length ft. | Length Used ft. | Total WQ Area SF |
| AA | 2747 | 4 | 687 | 989 | 20 | 49 | 127 | 20 | 6 | 20 | 400 | 1116 | 20 | 56 | 69 | 1389 |
| A | 2649 | 4 | 662 | 954 | 20 | 48 | 137 | 20 | 7 | 20 | 400 | 1091 | 20 | 55 | 68 | 1354 |
| B | 55628 | 6 | 9271 | 13351 | 80 | 167 | 8961 | 80 | 112 | 112 | 8961 | 22312 | 80 | 279 | 279 | 22312 |
| C | 1907 | 4 | 477 | 687 | 15 | 46 | 88 | 15 | 6 | 15 | 225 | 775 | 15 | 52 | 61 | 912 |
| D | 7780 | 4 | 1945 | 2801 | 40 | 70 | 360 | 40 | 9 | 40 | 1600 | 3161 | 40 | 79 | 110 | 4401 |
| E | 3322 | 2 | 1661 | 2392 | 40 | 60 | 154 | 40 | 4 | 40 | 1600 | 2546 | 40 | 64 | 100 | 3992 |
| F | 6665 | 2 | 3332 | 4799 | 40 | 120 | 309 | 40 | 8 | 40 | 1600 | 5107 | 40 | 128 | 160 | 6399 |
| G | 13208 | 2 | 6604 | 9510 | 50 | 190 | 611 | 50 | 12 | 50 | 2500 | 10121 | 50 | 202 | 240 | 12010 |
| H | 5949 | 2 | 2975 | 4283 | 40 | 107 | 275 | 40 | 7 | 40 | 1600 | 4559 | 40 | 114 | 147 | 5883 |
| I | 25531 | 2 | 12766 | 18383 | 90 | 204 | 1182 | 90 | 13 | 90 | 8100 | 19565 | 90 | 217 | 294 | 26483 |
| J | 5814 | 4 | 1454 | 2093 | 40 | 52 | 269 | 40 | 7 | 40 | 1600 | 2362 | 40 | 59 | 92 | 3693 |
| K | 1427 | 4 | 357 | 514 | 15 | 34 | 66 | 15 | 4 | 15 | 225 | 580 | 15 | 39 | 49 | 739 |
| L | 2823 | 4 | 706 | 1016 | 20 | 51 | 131 | 20 | 7 | 20 | 400 | 1147 | 20 | 57 | 71 | 1416 |
| M | 16265 | 2 | 8133 | 11711 | 60 | 195 | 753 | 60 | 13 | 60 | 3600 | 12464 | 60 | 208 | 255 | 15311 |
| N | 8461 | 4 | 2115 | 3046 | 35 | 87 | 392 | 35 | 11 | 35 | 1225 | 3438 | 35 | 98 | 122 | 4271 |
| O | 4482 | 4 | 1120 | 1613 | 25 | 65 | 207 | 25 | 8 | 25 | 625 | 1821 | 25 | 73 | 90 | 2238 |
| OO | 36051 | 4 | 9013 | 12978 | 70 | 185 | 1669 | 70 | 24 | 70 | 4900 | 14648 | 70 | 209 | 255 | 17878 |
| P | 6081 | 4 | 1520 | 2189 | 30 | 73 | 282 | 30 | 9 | 30 | 900 | 2471 | 30 | 82 | 103 | 3089 |
| Q | 14465 | 4 | 3616 | 5207 | 50 | 104 | 670 | 50 | 13 | 50 | 2500 | 5877 | 50 | 118 | 154 | 7707 |
| R | 3951 | 3 | 1317 | 1896 | 30 | 63 | 183 | 30 | 6 | 30 | 900 | 2079 | 30 | 69 | 93 | 2796 |
| S | 1595 | 4 | 399 | 574 | 15 | 38 | 74 | 15 | 5 | 15 | 225 | 648 | 15 | 43 | 53 | 799 |
| T | 1260 | 4 | 315 | 453 | 15 | 30 | 58 | 15 | 4 | 15 | 225 | 512 | 15 | 34 | 45 | 678 |
| U | 11482 | 5 | 2296 | 3307 | 40 | 83 | 532 | 40 | 13 | 40 | 1600 | 3838 | 40 | 96 | 123 | 4907 |
| V | 2259 | 4 | 565 | 813 | 20 | 41 | 105 | 20 | 5 | 20 | 400 | 918 | 20 | 46 | 61 | 1213 |
| W | 3681 | 4 | 920 | 1325 | 20 | 66 | 170 | 20 | 9 | 20 | 400 | 1495 | 20 | 75 | 86 | 1725 |